BALLISTIC MISSILE DEFENSE ORGANIZATION (BMDO)
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM

Submitting Proposals - Instructions

The responsibility for the implementation, administration and management of the BMDO STTR program is with the Office of Small and Disadvantaged Business Utilization. The BMDO STTR Program Manager is Frank P. Rucky, 703 697-3641. If you have questions of a specific nature, contact Mr. Rucky. For general inquiries or problems with the electronic submission, contact the DoD Help Desk at 866-SBIRHLP (724-7457). For technical questions about a topic, contact Mr. Rucky before **01 March 2002.** After 1 March, you must use the SITIS system listed in section 1.5c at the front of the solicitation or go to the DoD website at **http://www.acq.osd.mil/sadbu/sbir** for more information.

The fundamental objective of the Ballistic Missile Defense (BMD) program is to develop the capability to defend the forces and territories of the United States, its Allies, and friends against all classes of ballistic missile threats. The goal of the BMD System (BMDS) is a layered defense that provides multiple engagement opportunities along the entire flight path of a ballistic missile. BMDO will explore and demonstrate kinetic and directed energy kill mechanisms for potential sea-, ground-, air-, and space-based operations to engage threat missiles in the boost, midcourse, and terminal phases of flight. In parallel, sensor suites and battle management and command and control (BMC2) will be developed to form the backbone of the BMD System.

The boost phase is that part of flight when the ballistic missile's rocket motors are ignited and propel the entire missile system towards space. The boost phase lasts roughly 3 to 5 minutes for a long-range missile and as little as 1 to 2 minutes for a short-range missile. When the missile boosters are spent, the missile continues its ascent into the midcourse part of flight (which lasts nominally 20 minutes for a long-range missile). In the midcourse stage of flight, a ballistic missile releases its payload warhead(s), submunitions, and/or penetration aids it carried into space. The missile then enters the terminal phase when the missile or the elements of its payload, for example, its warheads, reenter the atmosphere. The terminal phase is a very short phase, lasting from a few minutes to less than a minute. There are opportunities and challenges to engage a threat missile in each of these phases.

The primary Terminal Defense Segment project is the Theater High Altitude Area Defense (THAAD) system. The mission of the THAAD System is to defend against short- and medium-range ballistic missiles at significant distances from the intended target and at high altitudes. This evolutionary program is structured to demonstrate capability in 2004, with planned improvements based on upgraded seekers, ground support equipment, and discrimination software. Current efforts are addressing component and system performance, producibility, and supportability.

The Midcourse Defense Segment program is divided into Ground-based Midcourse Systems and Sea-Based Midcourse Systems. The Ground-based Midcourse System has three objectives: 1) to develop and demonstrate an integrated system capable of countering known and expected threats; 2) to provide an integrated test bed that provides realistic tests and reliable data for further system development; and 3) to create a development path allowing for an early capability based on success in testing. The Sea-based Midcourse System is intended to intercept hostile missiles in the ascent phase of midcourse flight, which when accompanied by ground-based system, provides a complete midcourse layer. The Sea-based Midcourse System will build upon technologies in the existing Aegis Weapon System and the Standard Missile infrastructures and will be used against short and medium range threats.

The mission of the Boost Defense Segment is to define and develop boost phase intercept missile defense capabilities. To engage ballistic missiles in this phase, quick reaction times, high confidence decision-making, and multiple engagement capabilities are needed. The development of higher power lasers and faster interceptor capabilities are required. There are four principal objectives for the Boost Defense Segment. First, it will seek to demonstrate and make available the Airborne Laser (ABL). Second, it will define and evolve space-based and sea-based kinetic energy Boost Phase Intercept concepts. Third, this segment will execute a proof-of-concept Space-Based Interceptor Experiment (SBX). Fourth, it will continue Space-Based Laser (SBL) risk reduction on a path to a proof-of-concept SBL Integrated Flight Experiment (SBL-IFX). Kinetic boost phase intercept is a challenge because the threat missile must be detected

and confirmed within a few seconds of launch. It then becomes a race between an accelerating ballistic missile and the interceptor in which the threat missile has had a head start. Another technical challenge is designing a kill vehicle that can detect and track the target following missile-staging events and then impact the missile in the presence of a brilliant plume. BMDO is considering a sea-based boost activity to develop a high-speed, high-acceleration booster coupled with a boost kill vehicle.

A satellite system intended to support missile defense operations is the Space-Based Infra-Red Sensor (SBIRS). SBIRS-Low, in conjunction with SBIRS-High (developed by the Air Force), form the SBIRS system, which will consist of satellites in Geosynchronous Orbits (GEO), Highly Elliptical Orbits (HEO) and Low Earth Orbits (LEO) and an integrated centralized ground station serving all SBIRS space elements and Defense Support Program (DSP) satellites. The focus of BMDO is on SBIRS-Low, which will incorporate new technologies to enhance detection; improve reporting of Intercontinental Ballistic Missile (ICBM), Sea-Launched Ballistic Missile (SLBM) and tactical ballistic missiles; and provide critical mid-course tracking and discrimination data for BMD.

Finally, the Science and Technology (S&T) Program will develop components, subsystems and new concepts needed to keep pace with the evolving ballistic missile threat. The primary focus of the Technology Segment is the development of sensors and weapons for future platforms that can complement today's missile defense capabilities. Specific projects include the development of a doppler radar to be used in a missile seeker, the demonstration of active and interactive midcourse discrimination techniques, the design and development of miniature kill vehicles for boost and midcourse application, and the development and/or testing of space relay mirrors for laser tracking systems. In addition to thrust area projects, investments are made in technology at the component level to improve the state-of-the-art in radars, infrared sensors, lasers, optics, propulsion, wide band gap materials, and photonic devices.

The intent of BMDO's STTR Program, first and foremost, is to seek out the most innovative technology that might enable a defense against a missile in flight -- lighter, faster, smaller, stronger, more reliable, and less expensive technologies are all of interest. Proposing companies need not know specific details or requirements of possible BMDO systems, research and development goals, or specific technology needs or requirements, but must understand that potential technologies should have application and be relevant to ballistic missile defense at some level. (A better fire extinguisher, although it may be new and innovative and exhibit a potential commercial market, does not support ballistic missile defense requirements at any level.) All topics seek to solicit Research or Research and Development proposals from the small business community. Furthermore, all selections shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not yet been fully established.

PHASE I PROPOSAL SUBMISSION:

Read the DoD front section of this solicitation for detailed instructions on proposal format and program requirements. When you prepare your proposal, keep in mind that Phase I should address the feasibility of a solution to the topic. BMDO only accepts Phase I proposals with a base effort not exceeding $70,000. The technical period of performance for the Phase I should be 6 months. Phase I proposals have a 25-page limit (see section 3.3). BMDO will evaluate and select Phase I proposals using scientific review criteria based upon technical merit and other criteria as discussed in this solicitation document. Due to limited funding, BMDO reserves the right to limit awards to proposals considered to be of superior quality.

NEW REQUIREMENT: ALL PROPOSAL SUBMISSIONS TO THE BMDO STTR PROGRAM MUST BE SUBMITTED ELECTRONICALLY

It is mandatory that the **entire** technical proposal, DoD Proposal Cover Sheet, Cost Proposal, and the Company Commercialization Report are submitted electronically through the DoD SBIR/STTR website at **http://www.dodsbir.net/submission**. If you have any questions or problems with the electronic submission contact the DoD SBIR Helpdesk at 866-SBIRHLP (724-7457).

Complete electronic submission includes the submission of the Cover Sheets, Cost Proposal, Company Commercialization Report, the **ENTIRE** technical proposal and any appendices via the DoD Submission site. The DoD proposal submission site **http://www.dodsbir.net/submission** will lead you through the process for submitting your technical proposal and all of the sections electronically. Each of these documents are submitted separately through the website. Your proposal must be submitted via the submission site on or before the **3:00 p.m. EST, 17 April 2002 deadline.** A complete hardcopy will NOT be required. However, a signed original of the Cover Sheet (Appendix A) and a copy of Appendix B, needs to be submitted to this mailing address, by the solicitation close date:

Ballistic Missile Defense Organization
ATTN: SB/SBIR (RUCKY)
7100 Defense Pentagon, FOB#2
Washington, DC 20301-7100

Acceptable Formats for Online Submission: All technical proposal files will be converted to Portable Document Format (PDF) for evaluation purposes; therefore, submissions may be received in PDF format but other acceptable formats are MS Word, WordPerfect, Text, Rich Text Format (RTF), and Adobe Acrobat. The Technical Proposal should include all graphics and attachments, but not include Cover Sheets or Cost Proposal as they are submitted separately. Technical Proposals should conform to the limitations on margins and number of pages specified in the front section of this DoD Solicitation. However, your Cost Proposal will only count as one page and your Cover Sheets will only count as two, no matter how they print out after being converted. Most proposals will be printed out on black and white printers so make sure all graphics are distinguishable in black and white. It is strongly encouraged that you perform a virus check on each submission to avoid complications or delays in downloading your Technical Proposal. To verify that your proposal has been received, click on the "Check Upload" icon to view your proposal. Typically, your proposal will be uploaded within the hour. However, if your proposal does not appear after an hour, please contact the DoD Help Desk. It is recommended that you submit early, as computer traffic gets heavy nearer the solicitation closing and slows down the system.

BMDO FAST TRACK DATES AND REQUIREMENTS:

The Fast Track application must be received by BMDO 150 days from the Phase I award start date. Your Phase II Proposal must be submitted within 180 days of the Phase I award start date. Any Fast Track applications or proposals not meeting these dates will be declined. All Fast Track applications and required information must be submitted online through the DoD Submission website **http://www.dodsbir.net/submission**, and mailed to the BMDO STTR Program Manager at the address listed on the BMDO SBIR/STTR website (wimbmdo.com) and to the designated Contracting Officer's Technical Monitor (the Technical Point of Contact (TPOC)) for the contract. The information required by BMDO, is the same as the information required under the DoD Fast Track described in the front part of this solicitation.

PHASE II PROPOSAL SUBMISSION:

Phase II is the demonstration of the technology that was found feasible in Phase I. Phase II proposals may be submitted for an amount normally not to exceed $500,000. Companies may, however, identify requirements with justification for amounts in excess of $500,000. Only those Phase I awardees which have been **invited** to submit a Phase II proposal by the proper point of contact, during or at the end of a successful Phase I effort will be eligible to participate for a Phase II award. BMDO will also offer a "Fast Track" into Phase II to those companies that successfully obtain third party cash partnership funds ("Fast Track" is described in Section 4.5 of this solicitation). The type of contract award is at the discretion of the contracting officer. The preferred contract type for BMDO Phase II awards is Firm-Fixed Price.

Upon receiving an invitation, submission of a Phase II proposal should consist of three elements: 1) A base effort, which is the demonstration phase of the SBIR/STTR project; 2) A 2 to 5 page Transition/Marketing plan describing how, to whom and at what stage you will market and transition your technology to the government, government prime contractor, and/or private sector; and 3) At least one Phase II Option which would be a fully costed and well defined section describing a test and evaluation plan or further R&D. Phase II efforts are typically two (2) years and Phase II options are typically an additional six (6) months. Phase II proposals together with the Phase II Option are limited to 40 pages (unless otherwise directed by the TPOC or contract officer). All Phase II proposals must have a complete electronic submission. Complete electronic submission includes the submission of the Cover Sheets, Cost Proposal, Company Commercialization Report, the **ENTIRE** technical proposal and any appendices via the DoD Submission site. The DoD proposal submission site **http://www.dodsbir.net/submission** will lead you through the process for submitting your technical proposal and all of the sections electronically. Each of these documents are submitted separately through the website. Your proposal must be submitted via the submission site on or before the specified deadline. The DoD Activity that invited your PH II may also require a hardcopy of your proposal. A signed original of the Cover Sheet (Appendix A) and a copy of Appendix B, needs to be submitted to BMDO at this mailing address:

Ballistic Missile Defense Organization
ATTN: SB/SBIR (RUCKY)
7100 Defense Pentagon, FOB#2
Washington, DC 20301-7100

Effective in Fiscal Year 2002, BMDO will not issue a BMDO STTR Phase II award to a company when the elapsed time between the completion of the Phase I award and the actual Phase II award date is eight (8) months or greater; unless the process and the award has been formally reviewed and approved by the BMDO STTR Program Office.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria must be met or your proposal will be REJECTED.

____1. Your complete STTR PH I proposal (coversheet, technical proposal, cost proposal, and DoD Company Commercialization Report) has been submitted electronically through the DoD submission site by 3:00 p.m. EST 17 April 2002.

____2. The Phase I proposed cost for the base effort does not exceed $70,000.

BMDO FY02 STTR TOPIC DESCRIPTION

BMDO 02T-00

Title: Electronics and Superconductivity

Introduction: In implementing its TMD and NMD program activities, BMDO is continuing its developments of such efforts as the PATRIOT Advanced Capability-3 (PAC-3) missile system which has four major systems components: radar, engagement control station, launching station, and interceptors. The Navy Area Wide system will develop a sea-based capability that builds upon the existing AEGIS/Standard Missile air defense system. This system is based on the AEGIS-class cruisers and destroyers, which provide all elements of missile defense and are particularly suited to protecting forces moving inland from the sea. The Theater High-Altitude Area Defense System (THAAD) system will form the largest umbrella of missile protection in a specific theater, arching over all other missile defense systems. THAAD consists of four major systems components: truck-mounted launchers; interceptors; radar system; and battle management, command, control, communications, and intelligence (BMC3I). BMDO's increasingly sophisticated systems will provide the opportunity to destroy short and medium range ballistic missiles and other threats in the atmosphere far enough away that falling debris will not endanger friendly forces. The various BMDO technology and acquisition programs, in support of the TMD and NMD missions, are continually evaluating the latest advanced technology developments from industry as potential replacements for the current state-of-the-art sensor systems, components, sub-components, or piece part specifics. Research or Research and Development efforts selected under this topic shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not yet been fully established.

Description: The necessary advances in electronics for the many ballistic missile defense applications will require advances in electronics materials. Primary emphasis lies in advancing the capability of integrated circuits (>GB/s), detectors, sensors, large-scale integration, radiation hardness, and all electronic components. Novel quantum-well/superlattice structures that allow the realization of unique elective properties through "band gap engineering" are sought, as are new organic and polymer materials with unique electronic characteristics. In addition, exploitation of the unusual electronic properties of gallium nitride is of considerable interest, as well as, dramatic improvements of growth processes. Specific interests include, high speed switching conditions at >10GHz and/or cryogenic temperatures. Also, for high power, <10 GHz, SiC should be pursued for both semi-insulating bulk and epitaxial growth. Among the many BMDO electronic needs and interest are advances in high frequency transistor structures, solid state lasers, optical detectors, thermochromic films, low dielectric constant packaging materials, mixed-signal electronics, tailored thermal conductivity, microstructural waveguides, multilayer capacitors, single-electron transistors, clock-less logic ICs, metallization methods for repair of conducting paths in polyceramic systems, and sol-gel processing for packaging materials. Also, BMDO is interested in demonstrating both high temperature superconductor (HTS) and low temperature superconductor (LTS) devices to enable or improve strategic defenses. Emphasis in HTS technology focused toward components integrated with state-of-the-art cryoelectronics for communications systems at K- and S-bands and radar systems in the X-band power and inductive energy storage are of specific ballistic missile defense interest. The demonstration of HTS materials toward limited detection of radiation in the optical, IR, MWIR, and LWIR bands as well as for signal processing applications is also of interest. The emphasis in LTS technology is in the development and demonstration of high sensitivity detectors, digital electronics, and memory enabling on-focal plane array signal processing and operating at temperatures greater than 10K. Additionally, superconducting power technologies are of interest. Efforts should address packaging and interface issues and systems integration with cryocoolers and stored cryogens. Please indicate the particular identifying letter that your specific proposal/technology addresses:

BMDO/ 02-214A **– Electronic Materials**
BMDO/ 02-214B **– Electronic Devices**
BMDO/ 02-214C **– Superconductivity Materials**
BMDO/ 02-214D **– Superconductivity Devices**

Phase I: Demonstrate the likelihood that a new and innovative research and development approach can meet any of the broad needs discussed in this topic for future BMDO systems consideration.

Phase II: Develop applicable and feasible prototype demonstrations and/or proof-of-concept devices for the approach described, and demonstrate a degree of commercial viability.

Successful Phase 3/Dual-Use Commercializers (Real-World Examples): Company Y, with a market cap of $883M+, commercialized technology that allowed for the delivery of ultra-pure materials to semiconductor thin film reactors and has graduated from small business status. Company Z, with a market cap of $14M+, manufactures radiation detection devices and was funded for avalanche photodiode arrays under this topic. Company AA, with a market cap of $1,200M+, has a substantial

market share of the atomic layer epitaxy growth method of semiconductor compound materials based on their efforts developed under this topic. Company BB, with a market cap of $692M+, which manufactures flat panel display devices, received some initial funding for their silicon-on-insulator films and organometallic chemical vapor deposition technology developments. Company CC, purchased by a Fortune 100 company Apr 00, commercialized technology based on degradation resistant laser diodes. Company DD, with a market cap of $7M+, is commercializing technology based on its surge suppression devices and marketed as SurgX. Company EE, purchased by another larger company Feb 01 after graduating from small business status, had initial funding for its high bandgap compounds and laser diode products to develop a number of commercial and military products. Company KK established a multilayer coating technology, on which they have the worldwide patent, that can be easily transported to any location for application. Company FF developed a magnetoresistive non-volatile random access memory chip, which is also radiation hardened, and is utilized in a number of space applications for the military and commercial sectors. Company LL, with a market cap of $133M+, was started with their first Phase I from this topic and the products are used in electronics, structural ceramics, composites, cosmetics and skin care, and as industrial catalysts. Company NN, with a market cap of $574M+, is leveraging technology developed under this topic for the efficient production of semiconductors from waste recovery during the manufacturing process. Company GG, with a market cap of $113M+, fabricates optical components for industrial and military applications finds traceability back to superconducting detectors funded under this topic. Company HH, with a market cap of $103M+, demonstrated success from its technology based on multi-GHz superconducting shift registers.

DoD Key Technology Areas: Air Platforms, Materials/Processes, Sensors, Electronics, Battlespace Environment, Space Platforms, Weapons, Nuclear Technology